Industrial

Standardization

and Commercial Standards Monthly

"Garages . . . have a difficult problem in keeping the amount of carbon monoxide down to permissible limits." *Above,* how one garage solves the problem.

February

New Standards Set Safe Limits for Toxic Dusts and Gases (See page 29)

1941

For Defense

ON January 7th the Standards Council adopted a method of developing and approving Emergency Standards which materially shortens the length of time between initiation and completion of a project. This method is to be used specifically for standards needed to speed along defense production.

Why?

Standards are basic to the success of our national defense program. There can be no steady flow of blankets, tanks, trucks, airplanes, etc. from the factories and assembly lines of the country until agreement is reached on standards for materials, for fits of parts, for control of quality, etc. A single government order sometimes extends to hundreds of factories, and until we have a coordinated system of standards which will channel the raw materials through mills and factories and assembly plants to the government supply centers, we will not achieve the full production program which we are after.

With this new procedure in mind the committee which is working out allowable concentration limits for toxic dusts and gases used industrially has asked the ASA to authorize projects on the following eight substances: Acetone; Azides, lead and sodium; Cadmium; Ether; Manganese; Tetryl; TNT; and Xylol. All of these substances are, of course, widely used for defense purposes. Doubtless other projects in the mechanical and safety fields which have a bearing on defense production will also be put under the new shortened procedure.

In spite of the emergency, adequate safeguards are being provided to ensure that standards turned out under the new method will be good technical jobs. A final section of the new procedure states that "After the emergency shall have passed, the Defense Emergency Standards will be immediately reviewed by the appropriate correlating committees, and approved, amended, or withdrawn through the regular procedures of the Association."

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This Issue

Our Front Cover: Removing exhaust gas from automobiles in garage repair shop. Courtesy New York State Department of Labor, Division of Industrial Hygiene.

ASA

Reg. in U. S. Pat. Off.

Standardization is dynamic, not static. It means not to stand still, but to move forward together.

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New Standards Set Safe Limits For Toxic Dusts and Gases

by Surgeon Paul A. Neal[1]

Better protection for workers is expected as result of national agreement on safe amounts of carbon monoxide, hydrogen sulfide, carbon disulfide, and benzene in air of work places

A MILESTONE in progress toward protection of workers from the harmful effects of toxic dusts and gases was passed this month when the American Standards Association gave its approval to four new American Standards. These standards define the amount of carbon monoxide, hydrogen sulfide, carbon disulfide, and benzene which may be permitted in the air of work places without harm to workers. They are intended to serve as guide posts or caution lights which must not be exceeded if the health of the persons exposed is to be preserved, and should be particularly useful to those individuals or groups of individuals in industry, state health and labor departments, insurance companies, and others who are charged with the maintenance of the health of workers. The increasing rate of industrial activity at present with consequent increase of employment makes standards such as these even more important today than in the past.

In addition to their value to those working directly with health problems, these new standards are expected to serve as a basis for the engineer in designing methods for controlling harmful dusts, fumes, and gases. From this point of view, it may be well to point out that the limits as set forth in the standards are not merely medical or physiological limits but are limits which can be obtained and in most cases have been obtained without undue cost and restrictions on the industries concerned. As an example, we may cite a large rayon plant in which by means of a well designed ventilating system the carbon-disulfide concentration has been kept well below the permissible concentration outlined in the new standard.

Need for Limits Long Recognized

The need for allowable or permissible concentrations of dusts, fumes, mists, vapors, and gases in the air of workrooms to serve as a basis for the work of safeguarding employee health has been recognized for years.

Everyone is aware of the insidiously dangerous nature of carbon monoxide, which has no odor except in concentrations so high as to be fatal almost immediately. This toxic gas combines with the red pigment of the blood and in this way prevents the absorption and supply of oxygen to the tissues where oxygen is essential for the normal functions of the body. The wide distribution and frequent occurrence of carbon monoxide as the product of incomplete combustion of coal or organic (carbon-containing) materials, means that the hazards of carbon monoxide poisoning exist in many industrial operations and also in our daily life. In addition to the more commonly recognized occupations such as those connected with automobiles, garages, furnaces, and tunnels, etc., the occupations of baker, blast-furnace workers, boilerroom workers, calico printing, drying room workers, motion-picture film operators, plumbers, and patent-leather manufacture may be mentioned as only part of a long list.

Even though the exposure to carbon monoxide may not be sufficient to prove fatal, continued exposure to comparatively low concentrations may result in distressing symptoms such as severe headache, general irritability, insomnia, dizziness, and general weakness and lassitude.

Garages, particularly, have a difficult problem in keeping the amount of carbon monoxide down to permissible limits, especially on busy nights and under bad weather conditions, and engineers have spent much time and money to control the carbon monoxide concentrations in the great vehicular tunnels, such as the Holland Tunnel between New York and New Jersey.

[1] Chief, Research Section, Division of Industrial Hygiene, National Institute of Health, U.S. Public Health Service; member of ASA Sectional Committee on Allowable Concentrations of Toxic Dusts and Gases (Z 37).

Two actions of special importance were taken at the meeting of the ASA Sectional Committee on Toxic Dusts and Gases January 29. William P. Yant was elected chairman of the committee; and eight substances needed in connection with production for defense were placed on the list for development of standards under the new emergency defense procedure of the American Standards Association.

Mr. Yant is director of research and development, the Mine Safety Appliances Company, Pittsburgh.

Safe limits are to be determined under the emergency defense procedure of the ASA for the following eight substances:

Acetone	Manganese
Azides, lead and sodium	Tetryl
Cadmium	TNT
Ether	Xylol

Subcommittees have already been appointed by the sectional committee to prepare the emergency standards.

Members of the ASA Sectional Committee on Allowable Concentrations of Toxic Dusts and Gases (Z37) are:

William P. Yant, *Chairman*

American Association of Industrial Physicians and Surgeons, *Dr. Carey P. McCord*
American Institute of Chemical Engineers, *Reuel C. Stratton*
American Petroleum Institute, *Dr. James M. Adams; H. N. Blakeslee (alt)*
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The new standard provides that the maximal allowable concentration of carbon monoxide shall be 100 parts per 1,000,000 parts of air by volume with atmospheric oxygen not below 19 per cent by volume adjusted to 25 C and 760 mm pressure for exposures not exceeding a total of eight hours daily, and 400 parts per 1,000,000 parts of air by volume for exposure not exceeding a total of one hour daily.

Hydrogen sulfide, which is defined in the new standard as "a colorless gas having an offensive odor, as of rotten eggs at low concentrations, and a sweetish odor at high concentrations" among other more technical descriptions, is an irritating and a toxic gas. It causes irritation of the entire respiratory system and of the conjunctiva of the eye, and in high concentrations it may produce respiratory paralysis and neurological changes.

Hydrogen sulfide occurs naturally in the gases of volcanoes and in the water of certain spas, in mines, as for instance from the decomposition of pyrites and in certain sulphur-carrying brands of coal oil. It is formed wherever protein-containing materials are putrefying, as for instance in tanneries, the manufacture of glue, the washing of sugar beets, and in sewer gases. In the chemical industry hydrogen sulfide may be formed in many processes, as for instance in the manufacture of carbon disulfide, sulphur dyes, and of soda, if manufactured according to the LeBlanc process. Exposure to hydrogen sulfide may also exist in the rubber industry and the rayon industry in case the viscose process is used. The new standard for hydrogen sulfide also provides that the maximal allowable concentration shall be 20 parts per 1,000,000 parts of air for exposures not exceeding a total of eight hours daily, corresponding to 0.028 mg per liter.

Carbon disulfide is a toxic material which, in high concentrations, acts as a narcotic, whereas in low concentrations and with prolonged exposure it is a severe general nerve poison.

Exposure to carbon disulfide may exist in a number of industries. In the rayon industry, car-

bon disulfide vapors are developed especially in the preparation of viscose and in the spinning and washing operations. In the rubber industry the same hazard exists when carbon disulfide is used as a solvent for sulphur in cold vulcanization or as one of the solvents for rubber cement. It is also used as a fumigant. In the chemical industry, it is used as a solvent for fats, oils, and phosphorus; and in the manufacture of carbon tetrachloride, camphor, and of certain waterproof cements.

The new standard provides that the maximal allowable concentrations of carbon disulfide shall be 20 parts per 1,000,000 parts (corresponding to 0.062 mg per liter) of air for exposures not exceeding a total of eight hours daily. In addition, the standard defines carbon disulfide and provides methods for analyzing concentrations.

Benzene, the subject of the fourth standard, is another substance which is widely used and which therefore constitutes a difficult industrial hazard. Exposure to benzene may exist during the process of its manufacture and during its use as a solvent in different industries. Such hazards may also exist in the manufacture of lacquers and varnishes, paint and varnish removers, as well as in the manufacture of linoleum, artificial leather and rubber goods, and certain plastic materials. In addition, exposure may exist wherever benzene is used for cleaning purposes, such as dry cleaning, or in intaglio printing establishments.

Benzene (benzol) is a toxic material and should not be confused with benzine, a mixture mainly of aliphatic hydrocarbons. With acute exposure it acts predominantly as a nerve poison, causing depression of the central nervous system; with subacute and chronic poisoning it causes,

Research to control carbon monoxide from automobile exhausts in the great vehicular tunnels, the Holland Tunnel particularly, helped the ASA committee in its work on safe limits of toxic dusts and gases. (*Right*)—The Holland Tunnel. (*Below*) Holland Tunnel traffic on a holiday.

Photos Courtesy The Port of New York Authority.

in addition, damage of the blood, the blood forming organs, and the blood vessels.

The new standard provides that the maximal allowable concentration of benzene (benzol) shall be 100 parts per 1,000,000 parts of air for exposures not exceeding a total of eight hours daily.

Considerable data and information on allowable or permissible concentrations of dusts, fumes, mists, vapors, and gases in the air of workrooms has been published in books, pamphlets, journals, etc., but it is scattered widely and frequently differs considerably from source to source due largely to the different conditions under which the observations were made. Furthermore, the system of units used to express the concentrations, the spelling, and the general outline of presentation of the data had not been standardized up to the time the work of the ASA committee was started, so that this data may easily be misinterpreted by any but those wholly familiar with the field.

Central Standards Group Needed

As a result of this confusion, it became apparent within the past decade that a central standardizing group should review all the available information on the various air contaminants and arrive at some more or less definite value for the accepted allowable concentration, which value could be used without reserve in the design of control systems and in the estimation of the degree of hazard, if any, to which the workers are exposed.

The active beginning of the work which led to the four standard allowable concentrations now ready for issue (Carbon Monoxide, Hydrogen Sulfide, Carbon Disulfide, and Benzene) occurred April 25, 1935, with the authorization by the Standards Council of the ASA of a National Advisory Committee on Toxic Dusts and Gases. The organization of this committee was undertaken immediately, but it was not until January 31, 1936, that formal invitations could be extended to the individuals selected for membership. The first and only meeting of this committee was held on May 27, 1936.

The purpose of the National Advisory Committee was not to establish standards but to act as an advisory board to the existing ASA sectional committees charged with the duties of developing standards pertaining to occupational disease problems. No requests for advice had been received by the Advisory Committee as late as February, 1938, when a meeting of this committee was called to discuss many outside requests that the restrictions be removed from the National Advisory Committee so that this committee could proceed with the establishment of maximum allowable concentrations for the guidance of State regulatory bodies and other groups. The status of the committee was changed from advisory to sectional, operating under ASA procedure, April 14, 1938, with the following scope:

> "To determine, establish, and promulgate the allowable concentration limits of harmful gases, vapors, fumes, dusts, and mists; and other subjects related to the allowable concentration limits of such substances in the atmosphere of working places from the viewpoint of occupational disease prevention."

While research on the toxic effects of many dusts, fumes, mists, vapors, and gases is continuing in industry, governmental institutions, universities, and other places, the concentrations being set forth in the Z37 standards reflect the average or representative value of past work determined by a careful study of all published data and the experience of the members of the committee, all of whom are authorities on at least one phase of the whole subject. If future evidence shows that any of the values are substantially in error, the standard will be corrected accordingly.

Each dust, fume, mist, gas, or vapor on which action is taken is presented as an individual standard. The standards will follow a stereotyped style so that their use and adaptation will be convenient and widespread. Each standard will contain the following information on the contaminant in question:

1. Scope and purpose
2. Identification of contaminant
3. Standards of permissible range of concentrations
4. Sampling
5. Analytical methods
6. References

These first four standards are not the end of the committee's work by any means. Six additional standards have been drafted and are now before the committee for consideration, covering carbon tetrachloride, tetrachlor ethane, chromic acid, nitrogen oxides, lead, and mercury. Six others, now actively under way in subcommittees, cover trichlorethylene, tetrachlorethylene, formaldehyde, toluol, methanol, and hydrofluoric acid.

It is expected that the four standards now completed on carbon monoxide, hydrogen sulfide, carbon disulfide and benzene will be published soon and copies may be available within the next three weeks for use by industry, health authorities, and others concerned with the health of workers.

ASA Streamlines Approval Methods To Speed Standards for Defense

A STREAMLINED method for quick action in developing emergency standards for defense purposes was adopted January 7 by letter ballot vote of the Standards Council. The new procedure will make it possible to turn out standards for parts and materials used in defense production as rapidly as is consistent with a good technical job.

The committee devising the new method made this comment: "It is highly desirable that the American Standards Association be prepared to act promptly on requests for the preparation of standards for use in the national defense program. In order that such requests can be met with the speed that is essential, it is obviously necessary greatly to abbreviate the normal procedure of the association."

Under the new procedure, special committees will be empowered to act for the Association in starting new work, appointing technical committees and in approving emergency standards. The standards will be issued by the Association under authority of its Standards Council.

Any request for the development or adoption of such a standard will come before the chairman of the Council and if he decides the standard is urgently needed in the interest of national defense he will advise the Council to that effect. The chairman, together with the head of the appropriate correlating committee, will act for the Council on approval of the project, its scope, and the method of procedure to be used.

In the case of standards drafted by emergency technical committees, the draft will be referred to a reasonable number of key individuals in the groups substantially concerned with the subject.

The chairman of the Council will act for it on the approval of a defense emergency standard upon favorable recommendation of the correlating committee or the board of examination, but a one-sixth negative vote of a correlating committee or one negative vote of the board of examination will prevent the issuance of a standard.

All of the emergency standards will be issued in a distinctive format, with the words "defense emergency" appearing in the title. The newly adopted procedure provides that, following the emergency, the emergency standards will be reviewed by the appropriate committees, and approved, amended or withdrawn through the regular procedures of the Association.

Among the defense jobs on which the Association is already working are: Tool steels, screw threads, bolts, nuts, wrench head openings, machine pins, wire and sheet metal gauges, and statistical methods of quality control in mass production.

Eight standards for permissible concentrations of toxic dusts and gases were placed on the list at a meeting of this Committee January 29.

The British Standards Institution and the Standards Association of Australia have for some time both been issuing defense emergency standards developed under a similarly rapid procedure and such standards have been exceedingly valuable to the governments and industries of those countries in connection with their emergency war procurements.

The text of the Emergency Procedure as adopted by the ASA Standards Council is given in full below.

Defense Emergency Standards

Temporary Annex No. 1 to the Procedure of the American Standards Association Approved, January 7, 1941

(a) Defense Emergency Standards, developed or adopted under the following abbreviated procedure, may be issued by the Association under authority of the Standards Council.

(b) Any request for the development or adoption of such a standard shall be referred to the Chairman of the Standards Council. If in his opinion such a standard is urgently needed in the interest of

national defense, he shall so declare and shall notify the Standards Council to that effect.

(c) The Chairman of the Council, together with the Chairman of the appropriate correlating committee or committees, shall act for the Council on the approval of a project, the scope of the project, the method of procedure to be used, and where a project committee is necessary shall appoint its personnel.

(d) In the case of standards drafted by the Emergency Technical Committees, the draft shall be referred to a reasonable number of key individuals in the groups having a substantial concern with the subject of the standard, with the request that their comments be returned within a limited period of time. The Emergency Technical Committee shall consider all such comments, and in submitting the revised draft for action by the appropriate correlating committee shall report what disposition has been made of the comments.

(e) The Chairman of the Council shall act for the Council on the approval of a standard as a Defense Emergency Standard, upon favorable recommendation of the correlating committee concerned, or the Board of Examination, but a 1/6 negative vote of a correlating committee, or one negative vote of the Board of Examination, shall prevent the issuance of any such standard.

(f) The members of the Standards Council and of the correlating committee concerned, shall be informed promptly of all requests for standards, and of proposed scopes, methods of procedure to be used, personnel of committees, and submittals of standards for approval.

(g) All such Defense Emergency Standards shall be published in a distinctive uniform format. The words "'Defense Emergency" shall appear in the title, e. g.,
American Defense Emergency Standard Specifications for ....

(h) After the emergency shall have passed the Defense Emergency Standards will be immediately reviewed by the appropriate correlating committees, and approved, amended, or withdrawn, through the regular procedures of the Association.

ASA Authorizes Safety Code For Dry Cleaning Operations

A new project to develop a safety code for dry cleaning operations to be known as ASA project Z42, was authorized by the Standards Council of the American Standards Association January 29. The work will cover safety provisions, with the exception of fire hazards, for equipment used in dry cleaning operations and will have special reference to mechanical hazards and toxicity of fumes. It will be under the leadership of the National Association of Dyers and Cleaners.

All groups concerned with the problems of safety in dry cleaning will be invited to appoint representatives on an ASA sectional committee to prepare the proposed new safety code.

ASA Board of Examination Reappointed for 1941

The ASA Board of Examination, which acts as an advisory committee to the Standards Council on the approval of standards and initiation of new projects in miscellaneous fields which are not covered by the industry correlating committees of the ASA, was reappointed for the year 1941.

Members of the Board of Examination are:

W. C. Wagner, Electric Light and Power Group, *chairman*

Col. John K. Clement, War Department

R. B. Shepard, Fire Protection Group

T. E. Veltfort, Copper and Brass Research Association

H. P. Westman, Institute of Radio Engineers

John Gaillard, mechanical engineer on the ASA staff, is secretary of the committee.

Cellulose Plastics Manufacturers Find Savings Through Standards

The Cellulose Plastics Manufacturers Association states: "The products of the plastics industry are made up of a large variety of colors, dimensions, and gages of sheets, rods, and tubes, which would result in excessive inventories, waste, and loss to manufacturers and consumers, unless standardized within reasonable limits. This committee makes studies and recommendations as to standard grades, colors, and dimensions to meet trade requirements and minimize waste through excessive inventories and obsolescence."

Tolerances for Cylindrical Fits*

by John Gaillard

Mechanical Engineer, American Standards Association

II. The Influence of Tolerances on the Problem of Fits

So far, we have dealt with the ideal case that we could make the hole and the shaft to exact sizes chosen in such a way that the two parts, when assembled, give just the amount of clearance or interference desired.

Tolerances Indispensable

In practice, we cannot make a part to any predetermined exact size. We can aim at a specific size and by eliminating causes of variation—such as tool wear—approach that size very closely. However, there will always remain at work certain causes of variation that we cannot find and, therefore, cannot remove. The best we can do is to hold the size of a part between two limits, a maximum and a minimum, so that all variation in size will remain within the zone bounded by these limits—the *tolerance*. If we are able to maintain high accuracy, the limits may be kept closely together or in other words we may work to "close tolerances"—but we can never hope to make a hole or a shaft with "no tolerance" or "plus nothing, minus nothing", as we still find it sometimes specified on drawings.

Diagrams of Fits

The practical problem we have to face is represented by the diagrams, Fig. 5. The upper diagram shows the conditions governing a loose fit to be established between a number of holes and shafts of a given nominal size. Instead of getting holes of a definite size to be assembled with shafts of a definite smaller size, we now get holes in sizes varying between **H min** and **H max,**

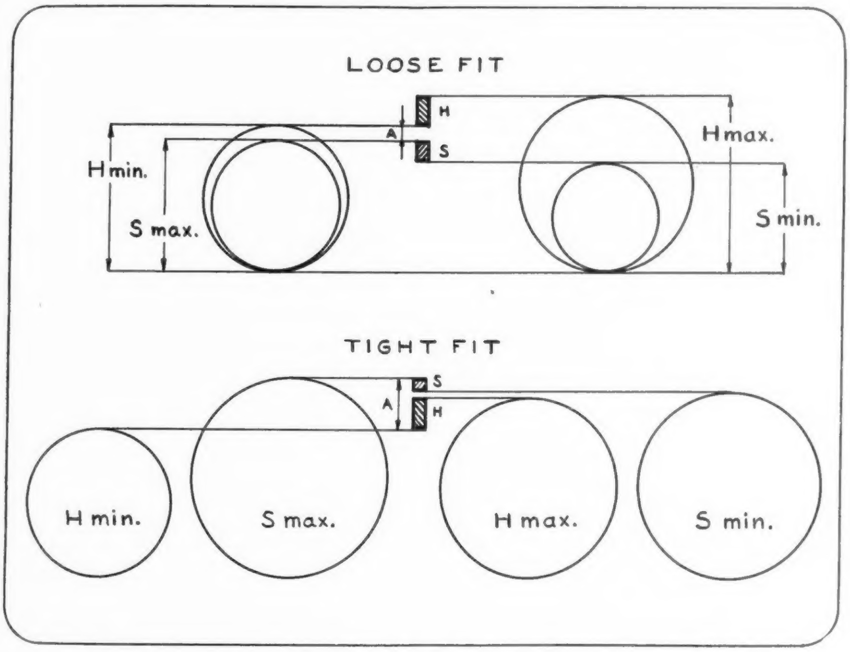


Fig. 5. Representation of fits by bar diagrams

* This discussion was originally presented as an informal talk before the Industrial Standards Group of the Industrial Management Council, Rochester, N. Y. It is being published in four instalments. The first (Industrial Standardization, Jan., 1941, pp. 13-16) deals with general principles in the ideal case where parts are made to exact sizes, no tolerances required. The control of fits by means of limit gages will be the subject of the third instalment (March), and a review of national and international systems will complete the discussion (April).

The entire article is now available in pamphlet form at 25 cents per copy.

and shaft sizes varying between **S max** and **S min.** The result is that the fit between a hole and a shaft may vary between two extreme conditions. One is the combination of the smallest permissible hole with the largest permissible shaft, shown in the upper left diagram, Fig. 5. This gives the minimum clearance and represents the condition of "maximum metal" of the mating parts. The other extreme is shown in the right, upper diagram, Fig. 5. It is the combination of the largest permissible hole and the smallest permissible shaft. Here, we get the maximum clearance and the "minimum metal" condition of the parts. Obviously, in a diagram of this kind, the clearances as shown are grossly out of proportion with the nominal size of the parts, this exaggeration being necessary to get a graphic presentation of the case.

The entire picture of this loose fit, as determined by the maximum and minimum limits of hole and shaft, can be given in a simple manner by means of a small bar diagram shown in the center of the upper diagram, Fig. 5. The bar **H** represents the tolerance on the hole and the bar **S**, the tolerance on the shaft. The bars **H** and **S** are separated by the distance **A** which is the minimum clearance required by the fit. The diagram shows us at a glance that the maximum clearance which may occur if we work within the tolerances **H** and **S**, is (**A** + **H** + **S**). It also shows that the maximum variation in clearance of this fit is (**H** + **S**). Both of these facts are of essential interest to the designer.

The lower diagram, Fig. 5, shows a similar representation of a tight fit. On the left, the smallest permissible hole **H min** is combined with the largest permissible shaft **S max,** thus giving the maximum metal condition and the greatest tightness obtainable. The least tight fit, which occurs between the largest permissible hole **H max** and the smallest permissible shaft **S min** (minimum metal condition), is shown on the right. The bar diagram in the center of the lower part of Fig. 5 shows at a glance that if **A** is the maximum interference, the minimum interference that may occur is (**A** — **S** — **H**). This value should still be sufficient to give the required holding power.

Bar diagrams of the type shown in the center of Fig. 5 for both kinds of fit are quite convenient in visualizing fits in terms of the tolerances on the mating parts and the minimum clearance or interference required. These data can easily be shown to scale, without the mating parts themselves being represented. In using diagrams of this kind, there is some advantage in making a distinction between bars representing hole tolerances and those representing shaft tolerances. It is recommended that a hole tolerance be indicated by cross-hatching the bar from the upper left to the lower right and a shaft tolerance, by cross-hatching from the upper right to the lower left. This facilitates our working with such diagrams, particularly in cases where we have to deal with several fits of different types represented in a single diagram. Therefore, the distinction just mentioned will be used here in the further diagrams to be shown.

The Three Basic Types of Fit

The bar diagrams make it easy to study the influence of tolerances on the three basic types of fit originally adopted in the discussion of the simplified problem.

Fig. 6 shows a series of fit diagrams which may be taken to apply to mating parts with a nominal size of one inch, the scale being in ten-thousandths of an inch or briefly, "tenths". The horizontal axis represents the nominal size of the mating parts and, hence, is the reference line from which the tolerances on the parts are located.

Diagram 1 applies to a clearance fit—minimum clearance **A** (one tenth), maximum clearance **B** (6 tenths). The heavy line on the left shows the maximum possible variation in clearance (**B** — **A**) which in this case is 5 tenths. An important point to note is this. One effect of giving tolerances on hole and shaft is that the clearance, instead of having a definite, constant value, may vary between 1 and 6 tenths. However, this fact does not change the basic character of the fit—it may be more or less loose, but it always remains a clearance fit.

Diagram 2, Fig. 6, represents a tight fit—maximum interference **A** (6 tenths), minimum interference **B** (one tenth). The heavy black line to the left of the vertical axis shows the possible range of variation in interference, which is (**A** — **B**) or in this case, 5 tenths. Since an interference may be considered as a negative clearance, the interference values are plotted on the negative portion of the vertical axis.

The tight fit, diagram 2, is the exact counterpart of the loose fit, diagram 1, Fig. 6, in so far as the maximum and minimum looseness or tightness values are the same in both cases, and also the maximum possible variation in looseness or tightness. Also, the tight fit, diagram 2, retains its basic character, even in the condition of minimum metal.

In the case represented by diagram 3, Fig. 6, the situation is different. Here, the fit may vary from a tight one with a maximum interference **A** (3.5 tenths) to a loose fit with a maximum clearance **B** (1.5 tenths). This is shown again by the heavy black line extending from above to below the horizontal axis.

We find, then, that the question as to whether we get a tight or a loose fit depends here on

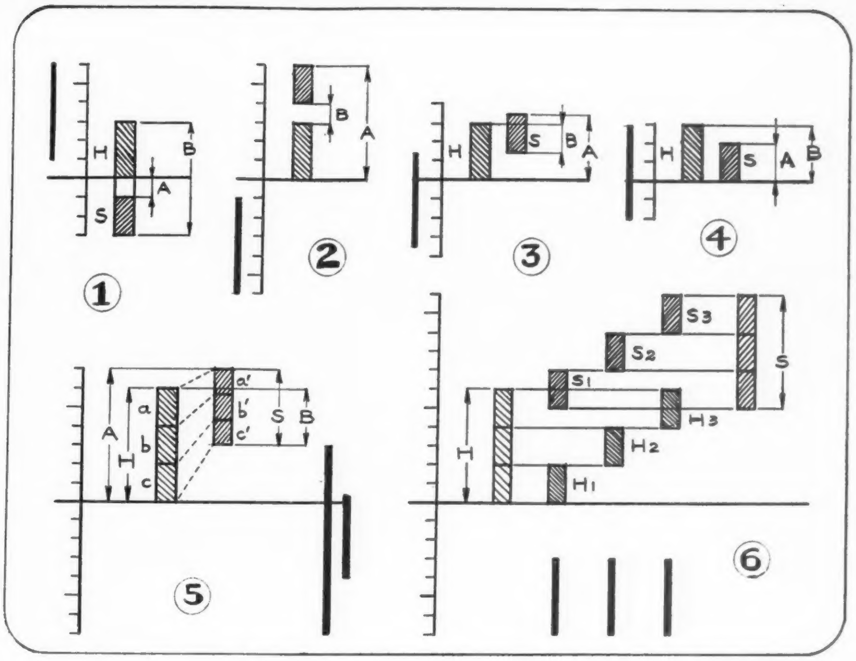


Fig. 6. Loose, tight, and transition fits. Selective fitting.

what hole is mated with what shaft. We may get either type and, hence, we may also get the type of fit lying between a loose and a tight one—what we have called a "neutral" fit. This will occur when a hole and a shaft are mated that have a common size lying within the overlapping range **B** of the tolerances **H** and **S**, in diagram 3, Fig. 6. And so, we discover here another effect resulting from the giving of tolerances on the mating parts:—the basic character of the fit may be changed from loose to tight.

In the fit represented by diagram 4, Fig. 6, this effect is still more pronounced. The intention here is to produce a "neutral" fit. Ideally, this could be achieved by holding the hole and the shaft exactly to the nominal size, represented by the horizontal axis. Since we have to give tolerances, the latter are kept small, and are located on the same side of the reference line, as closely as possible to it. In this way, we have the greatest chance of getting actual hole and shaft sizes that lie closely together. However, in spite of **H** being only 3 tenths, and **S** even as small as 2 tenths, this fit may still vary from one with a clearance of 3 tenths, to a fit with an interference of 2 tenths, as shown by the heavy line. Whether we get a "neutral" fit—that is, a fit between two parts with the same actual size—is still a matter of chance.

The significance of this case, diagram 4, is that we are unable fully to control the character of the fit—even though we are working to very close tolerances. We have to deal here with a so-called "transition fit", a term which may be interpreted in two ways. It may be taken to mean that such fits, as a group, form a transition between loose and tight fits, as groups. Or, it may be considered as meaning that the actual fits that may be obtained here form a complete transition from loose to tight fits. Whatever way we wish to take the meaning, we are faced here with a new problem of great practical importance.

Selective Fitting

The difficulty with transition fits is that the holes and shafts are not interchangeable in the same sense as in the case of holes and shafts intended for loose or tight fits. If in the case of diagram 4, holes held within the tolerance **H**, and shafts held within the tolerance **S**, are combined at random, we are bound to get a number of unsatisfactory fits.

This condition becomes worse if for some reason—which may be technical or economic—we do not want to give small tolerances on the parts, as shown in diagram 4, but prefer to keep them wider, as shown by diagram 5, Fig. 6. Let us assume, for example, that we want to produce a tight fit, the interference of which does not exceed 7 tenths. The tolerances **H** and **S**, diagram 5, meet this requirement. However, the possible variation in the character of the fit is here still greater than it was in the case of diagram 4, as

shown by the longest of the two heavy lines at the right, diagram 5.

The way in which this situation can be improved is also shown by diagram 5. The hole tolerance **H** (6 tenths) is divided into three equal zones **a**, **b**, and **c**, and the shaft tolerance **S** (4 tenths) is similarly divided into the zones **a'**, **b'**, and **c'**. The holes, which are held by the shop within the tolerance **H**, are sorted into three groups corresponding to the zones **a**, **b**, and **c**. The shafts, as they come from the shop, are also sorted into three groups, corresponding to the sub-tolerances **a'**, **b'**, and **c'**. If, now, holes lying within the zone **a** are mated exclusively with shafts lying within the zone **a'**, etc., the maximum possible variation in the character of the fits obtained is reduced to the extent shown by the shortest of the two heavy lines, diagram 5.

It will be seen that this procedure improves the situation a great deal. If the full tolerances **H** and **S** are used and the parts matched at random, the possible variation, diagram 5, is from a loose fit with a clearance of 3 tenths, to a tight fit with an interference of 7 tenths (long heavy line). By applying the principle of *selective fitting* just described, the variation is reduced to one ranging from a clearance of only 1/3 tenth, to an interference of 4 tenths (see short heavy line, diagram 5, Fig. 6). However, we may still get a slightly loose fit, instead of the tight fit we intended to establish.

This flaw can be eliminated by further improvement of the method of selective fitting shown in diagram 6, Fig. 6. The hole tolerance **H** (6 tenths) is divided here again into three zones of 2 tenths each: **H1**, **H2**, and **H3**. The shaft is given a tolerance **S** of 6 tenths (instead of 4 tenths, as in diagram 5) which is divided also into three zones of 2 tenths each: **S1**, **S2**, and **S3**. If, now, holes **H1** are matched with shafts **S1**, etc., we *always* get a tight fit whose interference lies somewhere between 3 and 7 tenths, as shown by the three equal short heavy lines, diagram 6, Fig. 6.

Selective Fitting or Close Tolerances?

Not only have the fits been improved, but we also benefit by the larger tolerance **S** on the shaft which makes for lower production cost. However, we have to pay the price for selective fitting in other ways. The holes and shafts must be sorted and kept sorted. Probably, in sorting the parts, we shall not get a shaft to go with every hole, giving a correct fit. The problem of servicing is complicated and may require the replacement of an entire subassembly, instead of a single part, due to the fact that the selective fitting must be done in the factory.

Therefore, in manufacturing practice, the question sometimes arises which solution is most advantageous: the random mating of holes and shafts kept between very close tolerances in order to establish complete interchangeability, or the selective fitting of holes and shafts which permits us to work within wider tolerances. The decision may require considerable study, involving the weighing of a number of factors which cannot be discussed here in detail.

In some cases there is no escape from selective fitting. This is true where the variation permitted in the looseness or tightness of a fit is small as compared to the tolerances on the parts and, also, where the hole and shaft tolerances overlap (see diagrams 4, 5, and 6, Fig. 6). This overlap occurs, for example, when we try to approach very closely what we originally called a "neutral" fit and what we still may call a "snug" fit. The man in the shop knows by experience that to produce such a fit always is an exacting job.

Grades of Parts and Fits

The use of tolerances introduces a new concept into the problem of fits which did not come up in its simplified version where we assumed that a part could be made to an exact size. This new concept is the *grade* of a part which gives us an indication of the accuracy to which its size is held. To explain this, diagram 1, Fig. 7, shows four different hole tolerances ranging from 7 to 2 tenths, applying to holes of the same diameter. We say that the grade of workmanship or briefly, the *grade*, of these holes increases from left to right. The same is true for shafts of the same size whose four tolerances are shown below the reference line in diagram 1, Fig. 7.

The concept "grade" also applies to fits obtained between holes and shaft, as shown by the further diagrams, Fig. 7. Diagram 2 shows four fits, all of which have the same allowance (minimum clearance) of one tenth. Therefore, all fits are of the same *class*. They also have the same maximum clearance of 7 tenths and, hence, the same range of *variation* in clearance. The latter fact is indicated explicitly by the four heavy lines on the right which refer to the four fits in the same order, from left to right. We say, then, that the four fits are of the same *grade*, because they have the same range of variation in clearance, just as we said before that four parts were of the same grade because they had the same range of variation in size, or in other words, the same tolerance.

The four fits in diagram 3, Fig. 7, again have the same allowance—one tenth. However, their maximum clearances are all different, being 9, 8, 7, and 4 tenths, respectively. Therefore, the

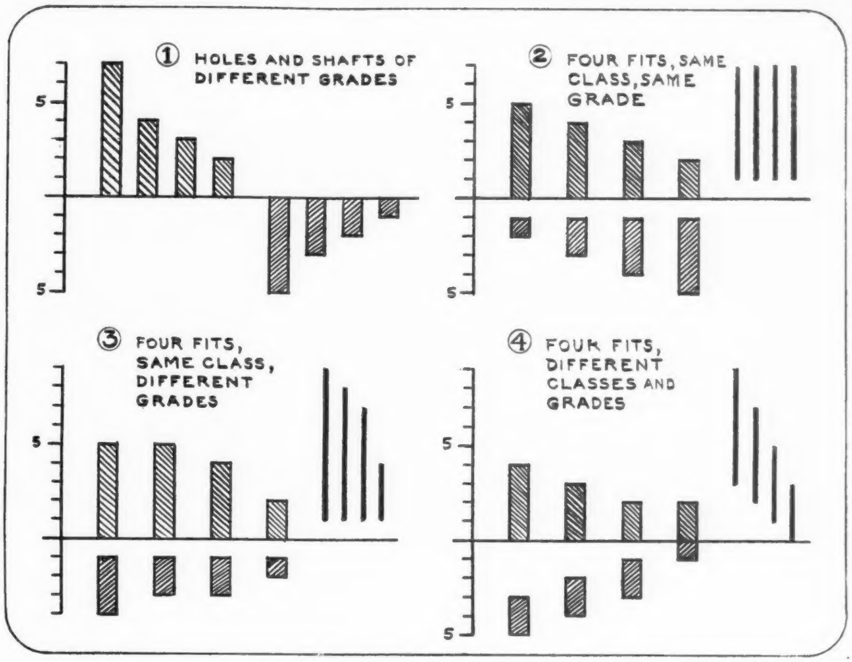


Fig. 7. "Class" and "grade" of a fit

four fits also have different maximum variations in clearance—these variations being 8, 7, 6 and 3 tenths, respectively, as shown by the four heavy lines. Here, then, we have four fits of the same *class*, but different *grades*. When we proceed from left to right, the grade of fit improves in each case.

To make the presentation complete, diagram 4, Fig. 7, shows four fits with different allowances (minimum clearances) and different maximum variations in clearance. Therefore, every one of these four fits differs from the others in regard to *class* as well as to *grade*.

The terms "class" and "grade" as applied to fits have not yet been generally adopted. The ATS, B4a—1925, gives the concept "class", but not that of "grade". I believe that to adopt this term and keep clearly in mind the distinction between class and grade will greatly help to clarify the discussion of problems of fit.

Grade or Quality?

Instead of the term "grade", the term "quality" is sometimes used, either in reference to a part or a fit. While the two terms are practically synonymous, it appears that the term "grade" should be preferred where we have in mind the possible amount of variation in the character of a fit. The reason for this is that in recent years it has become general usage to speak of the "quality" of a surface—for example, in speaking of a grinding finish. This concept, surface quality, often comes up in connection with fits because it may be of direct importance to the performance of the mating parts when assembled. It may affect the smoothness of a running fit or the holding power of a tight fit. However, the variations in a surface that determine "surface quality" are, generally speaking, of a different order of magnitude than the possible variations in looseness or tightness of a fit. Therefore, to keep a clear distinction between the two, I should like to propose that we consistently speak of the "quality" of a surface and the "grade" of a part or a fit.

Unilateral System of Tolerances

When tolerance systems are discussed, the question often arises: "What is better—a unilateral system or a bilateral one?" Let us first see what is meant by these two terms.

In Fig. 8, on the left, are given the tolerances for two different fits between a hole and a shaft with a nominal size of one inch. For the fit on the extreme left, the tolerance **H1** is "plus 6 tenths, minus nothing". The allowance (minimum clearance) of the fit is 2 tenths and, hence, the high limit of the shaft is .9998 in. Taking this dimension as the basic size of the shaft, we can specify its tolerance **S1** as being "plus nothing, minus 4 tenths". The fit between hole

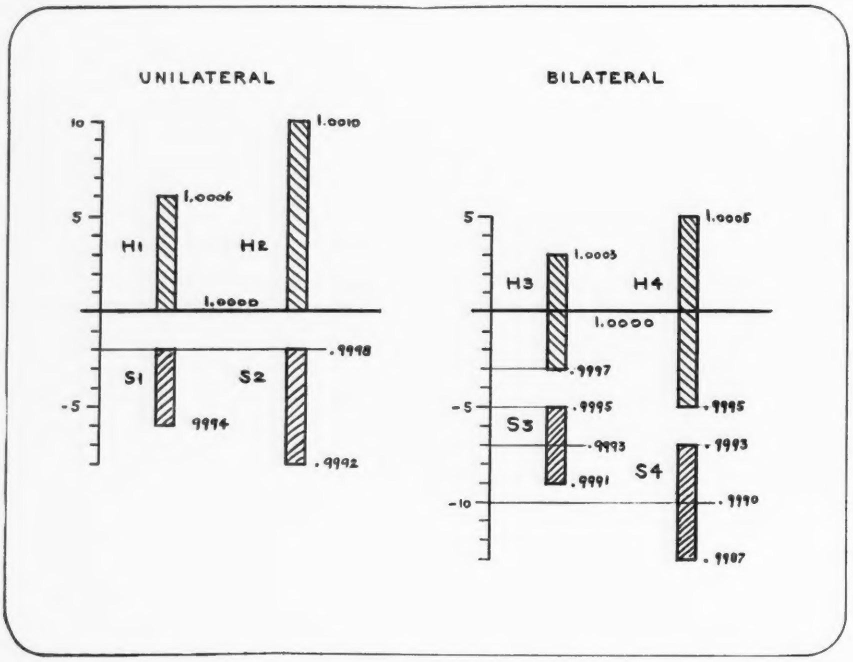


Fig. 8. Unilateral and bilateral tolerances

H2 and shaft **S2** is of the same class as the combination **H1/S1**, but of a coarser grade. The hole tolerance **H2**, referred to the basic size of one inch, may be expressed as "plus 10 tenths, minus nothing". The shaft tolerance **S2**, referred to the basic shaft size of .9998 in., is "plus nothing, minus 6 tenths".

In this system, the *low limit of the hole* and the *high limit of the shaft* are considered as the *basic sizes* of the respective parts, from which sizes the tolerances are measured. The tolerance on each part is given in one direction only—plus for the hole, and minus for the shaft. Therefore, the tolerance on a part is "one-sided" or "unilateral", and this system of giving tolerances is called accordingly, the *unilateral system.*

Advantages of Unilateral System

The diagram on the left, in Fig. 8, shows at a glance that in a unilateral system all holes and shafts giving a fit with the same allowance (2 tenths, in this diagram) can be cross-combined and still will give a fit of the same *class*; only the *grade* of the fit will vary. For example, the fit **H1/S2** is of a coarser grade than **H1/S1**, but of a finer grade than **H2/S2**. Similarly, the fit **H2/S1** is of a finer grade than **H2/S2**. However, all of the four combinations that are possible between holes **H1** and **H2,** on the one hand, and shafts **S1** and **S2**, on the other, will be of the same class.

This characteristic of the unilateral system presents a great advantage in practice. It permits us to change the tolerances on holes or shafts without impairing the essential character of the respective fits. For example, it may happen that in bringing out a new product the manufacturer wishes to be on the safe side and, therefore, adopts rather close tolerances **H1** and **S1** on the mating parts. After the product has been out in the field for some time, the manufacturer finds that he can safely increase the tolerances to **H2** and **S2** because the increased maximum looseness of the fit appears not to be objectionable with a view to good performance of the mating parts. And since larger tolerances mean lower cost of production, the manufacturer will be glad to make the change.

Bilateral System of Tolerances

If, now, we look at the diagram on the right, in Fig. 8, we find the same two fits as just discussed, but here they are specified in a different manner. For example, in the fit of the highest grade, **H3/S3**, the hole tolerance **H3** (6 tenths) is given as "plus and minus 3 tenths" on the basic hole size (1.0000 in.). Therefore, the hole limits in this case are 1.0003 and .9997 in. In the same way, the shaft tolerance **S3** (4 tenths) is given as "plus and minus 2 tenths" on the basic shaft size (.9993 in.) so that the shaft limits are .9995 and .9991 in. In this system, the tolerance on

a part extends in both directions from a basic size and is, therefore, "two-sided" or "bilateral" —hence, the name "bilateral system of tolerances".

Let us assume that a manufacturer using the bilateral system has given the tolerances **H3** and **S3** on two parts of a new product and that here, again, he finds after some time that he can increase the tolerance on the hole from 6 to 10 tenths and the tolerance on the shaft from 4 to 6 tenths. The new tolerances **H4** and **S4** will then be located as shown on the extreme right, in Fig. 8. The hole **H4** will be "1.0000, plus and minus 4 tenths" and the shaft **S4**, ".9990, plus and minus 3 tenths".

The fit **H4/S4** is of the same class as **H3/S3**, but the holes **H3** and **H4**, and the shafts **S3** and **S4** cannot be combined at will and still give the same class of fit in each combination. For example, a shaft **S3** having a size close to its high limit will give too small a clearance with a hole **H4** lying close to its low limit. Consequently, it will *not* be possible, in a bilateral system, to change smoothly from one grade of work to another—as we found the manufacturer could do in the unilateral system.

Modern Systems Are Unilateral

The advantages of a unilateral system of tolerances over a bilateral one have led to the exclusive adoption of unilateral tolerances in all modern standard systems of fits. When the tolerance concept was originally developed, there was a natural tendency to use bilateral tolerances: the designer had in mind to *aim* at a definite size and, therefore, was inclined to specify a maximum permissible deviation on either side of that size—which directly led to a bilateral tolerance. However, as the principles underlying the building up of a tolerance *system* came to be studied, especially with a view to the requirements of interchangeable manufacture and mass production methods, the unilateral system was found to be preferable. In fact, in mass production, the common procedure is to work between two limits, rather than to aim at a definite size.

The change in trend is clearly shown by the evolution of the present British Standard. In 1906, the British adopted a national system based exclusively on bilateral tolerances. In 1924, they revised this system to give tolerances in the unilateral as well as in the bilateral system,—the unilateral being recommended for use "where it does not conflict with predominating practice". This recommendation applies, therefore, in all cases where a tolerance system has to be newly introduced.[2]

All other national standard systems developed during the last twenty years and also the ISA System, the general set-up of which will be shown later, are based exclusively on unilateral tolerances.

[2] British Standard, Limits and Fits for Engineering (BS 164-1924).

(Part III, Control of Fits, will appear in our March issue. In view of the vital nature of the fits problem in defense manufacturing, the entire article has been published in pamphlet form and is now available at 25 cents per copy.)

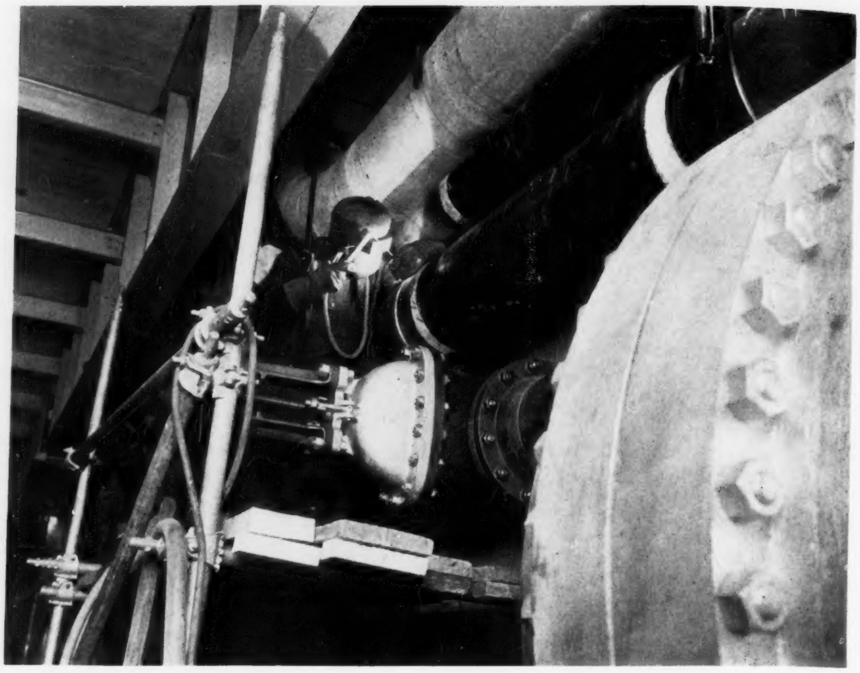
New List Covers Army and Navy Electrical Specifications

A list of Army and Navy electrical specifications has been compiled by the National Electrical Manufacturers Association to make it possible to locate these specifications more readily. The Index of Specifications issued by the Navy Department for Naval Stores and Materials (January 2, 1940), and the Index of U.S. Army and Federal Specifications issued by the War Department (January, 1940) from which the new list was taken, place electrical specifications under various other industry classifications. This makes it difficult for any one primarily interested in electrical questions to find all the specifications dealing with electrical apparatus or devices. Electrical refrigerators, for instance, are placed under the Furniture classification in the Navy Department's Index.

Copies of the new mimeographed list of Army and Navy electrical specifications are available from the National Electrical Manufacturers Association, 155 East 44th Street, New York.

Directory of Organizations On Public Administration

The 1941 directory of voluntary unofficial organizations working in the field of public administration in the United States and Canada has just been published by the Public Administration Clearing House. The directory, which is the fifth edition, includes not only organizations composed of public administrators but also those which, by cooperation or the joint occupancy of particular fields of work, affect the course and practice of public administration. Copies of *Public Administration Organizations, a Directory, 1941* may be ordered from the Public Administration Service, 1313 East 60th Street, Chicago, Ill. at $1.50 each.



Operator at work on a welded pipe joint in a power plant.

by Sabin Crocker[2]

ASA Approves First Standard For Welded Pipe Fittings[1]

Steel butt-welding fittings are covered in new American Standard

Subcommittee continues work on socket welding fittings and backing strips

IN THE light of today's acceptance of fusion welding, most recently evidenced in the approval of the new American Standard for Butt Welding Fittings,[3] the fact is often overlooked that this art was comparatively undeveloped and was used only to a very limited extent as recently as nine or ten years ago. Fusion-welded boiler drums were not countenanced by the ASME Boiler Code Committee until 1931, and up to that time this implied distrust of welding tended to dampen the enthusiasm of those who otherwise might have tried to weld the high-pressure joints in their power piping systems.

This comparatively recent acceptance of welded construction by the Boiler Code Committee was finally brought about primarily because welding operators successfully demonstrated their ability to produce sound welds during qualification tests. In addition, however, certain special requirements covering stress relief and non-destructive examination of the weld metal for flaws were found to provide safeguards for severe service conditions. About this time, too,

[1] Adapted from an article by Mr. Crocker published in Heating, Piping and Air Conditioning, January, 1940.

[2] Chairman, Subgroup 6 on Standardization of Welding Fittings, ASA Committee on Pipe Flanges and Fittings; Senior Engineer, Engineering Division, The Detroit Edison Company.

[3] B16.9-1940. Prepared by the ASA Sectional Committee on Pipe Flanges and Fittings (B16), under the Leadership of the American Society of Mechanical Engineers; the Heating, Piping, and Air Conditioning Contractors National Association; and the Manufacturers Standardization Society of the Valve and Fittings Industry.

engineers had begun to sense the effect of chemical composition on the weldability of steel, as well as to appreciate the advantages of coated electrodes and multipass work for arc welding and of the reducing flame for gas welding.

None of these contingent advances in knowledge of the art of welding, which gave so sudden an impetus to its universal acceptance, were given much thought until about 1930. Hence, it is only within the past decade that fusion-welded pipe joints have come into sufficient use to arouse interest in the formulations of safety codes governing the quality of welding and details of attachment, or in writing specifications defining the composition of metals suitable for welding, or finally in setting up standards for the overall dimensions of readymade welding fittings, as has now been done in the new American Standard.

There is usually no particular incentive for setting up a standard until industry has built up a demand for the product in question and various sources of supply start offering equivalent articles of varying dimensions. Standardization then enters the picture in an effort to resolve the discordant product into a single common denominator. This delay before attempting to standardize not only postpones the benefits thereof, but often results in several manufacturers having to alter their shop equipment in order to make their respective products conform.

Although the new standard for butt-welding pipe fittings is the first for welded fittings, other standards have been approved by the American Standards Association for pipe fittings. These include:

- Cast-Iron Pipe Flanges and Flanged Fittings, Class 125 (B16a-1939)
- Cast-Iron Pipe Flanges and Flanged Fittings for Maximum WSP of 250 lb (B16b-1928)
- Cast-Iron Pipe Flanges and Flanged Fittings for 800 lb Hydraulic Pressure (B16b1-1931)
- Cast-Iron Pipe Flanges and Flanged Fittings for Maximum WSP of 25 lb (B16b2-1931)
- Malleable-Iron Screwed Fittings, 150 lb (B16c-1939)
- Steel Pipe Flanges and Flanged Fittings (For maximum WSP of 150 to 2500 lb per sq in., including welding neck flanges) (B16e-1939) with Addendum (B16e4-1940)
- Pipe Plugs of Cast Iron, Malleable Iron, Cast Steel or Forged Steel (B16e2-1936)
- Cast-Iron Long-Turn Sprinkler Fittings (B16g-1929)
- Steel Butt-Welding Fittings (B16.9-1941)
- Face-to-face Dimensions of Ferrous Flanged and Welding End Valves (B16.10-1939)

Copies of these standards may be ordered from the American Standards Association.

While this deliberate procedure seems wasteful in one sense, nevertheless it is preferable to impeding progress through prematurely stifling those impulses to invent or originate which contribute so much to real progress. Perhaps this explains why an American Standard for readymade *butt* welding fittings has only just now evolved through the procedure of the American Standards Association whereas the first brand of this product appeared on the market some ten years ago.

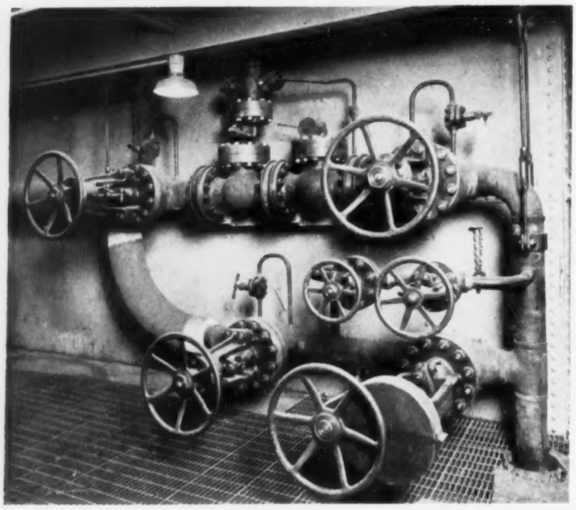
Other Standards Planned

A proposed standard for *socket* welding fittings will be completed later owing to the commercial situation now existing with respect to this type of fitting. Sometimes, before a consensus can be reached, it is necessary to take time for trial in service or for learning how the consuming public responds to the appeal of different designs as an indication of which should be adopted as standard. Then, too, it may take time for the manufacturers to work out between themselves a mutually acceptable set of compromise dimensions which do not place all the burden of conforming on one or two manufacturers to the advantage of others whose dimensions happen to suit. This situation was manifest in the case of *socket* welding fittings where divergent viewpoints are being reconciled through the cooperation of those involved.

The subgroup on Dimensions of Welding Fittings of the ASA Sectional Committee on Pipe Flanges and Fittings, which has been working on these standards, also has considered standardization of the related product, backing strips, for use in making welded joints. It found, however, that practice differed so greatly between different users, and design changes were being made so rapidly, that it was neither feasible nor desirable to standardize on backing strips at present. When practice has become somewhat more uniform, further consideration may be given the matter by the subgroup. The subgroup now has under consideration standardization of dimensions for laterals, reducing tees, etc., agreement on which, however, has not yet been reached.

Conflicting Dimensions

The need for standardizing butt welding fittings became evident to some of the users of these fittings about four years ago. Aside from having in use three sets of center-to-end dimensions for elbows embracing short, medium, and long radius with variations in each series depending on the manufacturer, there were two radically different styles of branch outlets for tees, and numerous



By-pass around automatic feed-water regulator for 865-lb boiler in large central station.

The factory-made welding ell and tee correspond to Schedule 80 fittings in the new American Standard B16.9-1940. Flanges on regulator valves are provided to facilitate removal for servicing. Note the neater appearance where welded ends can be used instead of flanges.

inconsistencies in the dimensions of tees on the run, and of reducers, caps, and the like. Owing to this situation, it was necessary for the user of welding fittings to select one manufacturer and stick to his line of fittings in order to avoid conflict of dimensions in making detail drawings or in field erection. If the fittings of another manufacturer were purchased inadvertently and mixed with those intended for the job, the pipe line as actually erected in the field was apt to be several inches too long or too short, or to have branch outlets unexpectedly misplaced as a result of variation in overall dimensions of welding fittings.

This situation was equally bad for both manufacturers and consumers, since if a consumer had to confine his purchases to one brand for uniformity this tended to exclude other manufacturers from competing for the business. Consequently, when the need for standardization was broached to the manufacturers they agreed wholeheartedly. The resulting standard, prepared by a committee representing manufacturers, users, and other groups concerned, and approved by the American Standards Association, covers overall dimensions, tolerances, and marking for the more common butt-welding fittings.

The standard includes overall dimensions, tolerances, and marking for 45 and 90-deg elbows, 180-deg return bends, concentric and eccentric reducers, caps, and lapped-joint stub ends. Dimensions of tees are given on the run only, because agreement among manufacturers has not yet been reached on the branch dimension of either full-size branch outlet tees or those reducing on the branch. As a practical compromise the center-to-end dimension of 90-deg elbows was made approximately $1\frac{1}{2}$ times the nominal diameter, with 45-deg elbows and return bends shaped to agree.

Refers to Standard Dimensions

Standard dimensions for welding neck flanges already published in the American Standard for Steel Pipe Flanges and Flanged Fittings (B16e-1939) cover a considerable number of pages, so it was not considered expedient to reproduce them with the welding fitting standard. It might be well to point out also that the present proposed standard is limited to what are aptly described as ready-made or factory-made fittings. There is no occasion, therefore, for it to include rules for the reinforcement of welded branch connections fabricated in field or shop or for other built-up fittings. The construction of these fittings can better be left to the rules of the American Standard Code for Pressure Piping.

With respect to metal thickness at the welding ends, the standard mentions that the dimensions of the welding bevel are to match pipe and they must, therefore, conform to established pipe standards. For this reason, dimensions at the welding ends are specified to comply with the schedule number system of the American Standard for Wrought-Iron and Wrought-Steel Pipe (B36.10-1939) on such sizes as are available, and those wall thickness schedules are included for reference. This practice of designating standard wall thickness is intended to supplant the use of "standard weight," "extra strong," and "double extra strong," which is fast becoming obsolete. Fittings are required to be equal in bursting strength to pipe of the designated schedule number and material.

Hydrostatic Testing Not Required

Routine hydrostatic testing of fittings is not required (except of those made by casting) unless specifically called for in the order. To meet code requirements and to provide for demonstrating the strength of design it is provided, however, that fittings shall be capable of withstanding a hydrostatic test made according to rules prescribed therefor.

Included in the standard is a recommended practice for the beveling of welding ends which also appears in connection with welding neck

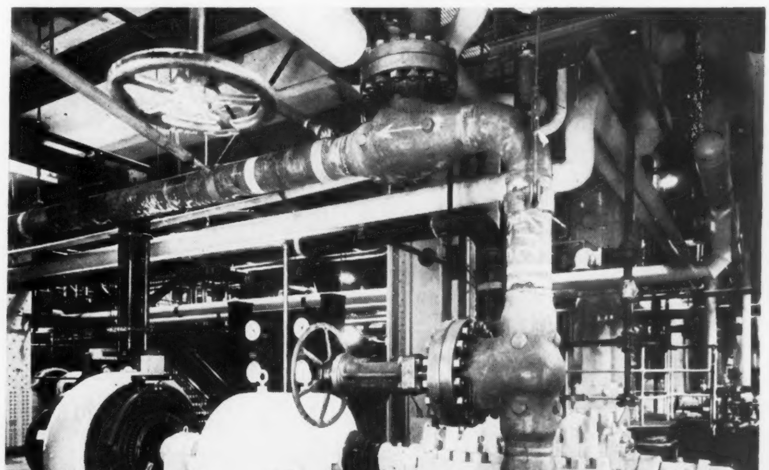
flanges in a recent edition of the American Standard for Steel Pipe Flanges and Flanged Fittings (B16e-1939). Two cuts (Figures 1 and 2) are given here to illustrate the respective bevels for wall thicknesses of 3/16 to ¾ in., inclusive, and for thicknesses greater than ¾ in. Owing to a prevalent misconception as to what constitutes recommended practice for welding bevels, particular attention is directed to these details. The present recommended practice contemplates a 37½-deg beveled end for wall thicknesses from 3/16 to ¾ in. inclusive rather than the 45-deg bevel common with the trade a few years back. A further reduction in angle of bevel to 30 degrees is now under consideration.

Concurrently with the sectional committee's work on the dimensional standard, a subcommittee of the American Society for Testing Materials has formulated a materials specification for welding fittings. This specification is predicated on the existence of numerous ASTM specifications for steel pipe, forged or cast fittings, and plate, which are also suitable for ordering the material used in the manufacture of ready-made welding fittings. The idea of the ASTM subcommittee has been, therefore, to draft a master specification for welding fittings which will incorporate all appropriate ASTM specifications through cross reference and furnish such further requirements as may be needed to provide for heat treatment and testing of the finished product. Such a master specification for carbon steel and carbon molybdenum steel welding fittings was published last year with the designation A 234-40 T. Probably a separate specification set up along similar lines will be required for fittings made of the various alloy steels if and when alloy welding fittings are used in sufficient quantities to justify a national standard.

Acceptance by Industry

A draft of the new American Standard for Butt Welding Fittings was submitted in 1938 for comment to the members of committee B16 and to about 100 firms representative of industry or concerned with the manufacture or use of the product. A considerable number of letters received as a result of this inquiry were considered by subgroup 6 at a meeting in May, 1939, and many of the suggestions were approved and incorporated in the standard.

While it is obviously impossible to reconcile all opposing views within one standard, members of the subgroup feel that conflicting ideas have been sufficiently well harmonized to permit almost universal acceptance of the standard in its present form. For the accomodation of those who still want something different, the standard provides: "It is recognized that special fittings other than those specifically covered by this standard are available and may be ordered as required by the purchaser."



High-pressure piping at discharge of 1000 to 1200 psi boiler-feed pump in large central station.

The factory-made welding ell corresponds to Schedule 80 fittings in the new American Standard B16.9-1940.

Photos Courtesy Detroit Edison Co.

As far as is known, the manufacturers of welding fittings have been 100 per cent represented on the working committees which formulated this dimensional standard and they have been unanimous in agreeing to conform. In some cases this has entailed a considerable sacrifice in scrapping existing tool equipment or in superseding or relegating to a special classification certain lines of nationally advertised fittings. The manufacturers of this product are to be commended for the cooperative spirit of give and take manifest by them throughout the whole undertaking.

British, New Zealand, and Australian Draft Standards

DRAFT standards have been received by the American Standards Association from Great Britain, New Zealand, and Australia. These are listed below and may be borrowed by members of the American Standards Association from the ASA Library.

Great Britain

Performance of Ceiling Type Electric Fans, Submitted by the B.E.A.M.A. (CF(EL)6948 Draft Revision of 367-1932)

Test Code for Continuous Vertical Retorts (CF(GS)7132)

New Zealand

Standard Methods for the Chemical Analysis of Butter and Cheese (No. D 1291)

Ready Mixed Paints for Finishing Coats for Woodwork—Light and Cream Tints (No. D 1405)

Market Milk and Cream (No. D 1406)

Pale Boiled Linseed Oil (No. D 1415)

Australia

Materials and Constructional Strength of Portable Chemical Fire Extinguishers of the Carbon Tetrachloride Type (To be No. A 45)

Laminated Synthetic Resin Bonded Sheet (Fabric Base) For Use as Gear Material (To be No. B 77)

Code for Fibrous Plaster Products together with Specifications for Gypsum Moulding Plaster and Fibrous Plaster Products (To be No. CA 20)

Testing the Zinc Coating on Galvanized Articles (To be No. K 53)

Comments on the New Zealand draft for Standard Methods for the Chemical Analysis of Butter and Cheese may be received at the New Zealand Standards Institute until May 31. The Standards Association of Australia has requested comments on the draft for Materials and Constructional Strength of Portable Chemical Fire Extinguishers until May 31, and for Testing the Zinc Coating on Galvanized Articles until March 31. The ASA will be glad to forward such comments.

ASA Committee Lists Building Code Data

A bibliography of material recommended as suitable for use in preparing or revising local building codes has been compiled by the Building Code Correlating Committee of the American Standards Association. With the exception of the reports of the Department of Commerce Building Code Committee which it has accepted as a basis for its work, the correlating committee has expressed no opinion on the merits of the various recommendations. Eventually, it expects to have a series of recommendations of its own prepared by sectional committees on all the subjects customarily covered in building codes. Until this material is available, this list of source material is presented representing a selection of items available from responsible organizations. The extent to which the material should be incorporated in codes is a matter for the judgment of officials or committees undertaking local work.

Copies of the document, Information on Sources of Material for Use in Preparing and Revising Local Building Codes (CB 62), are available without charge from the American Standards Association.

National Forum Will Discuss Fuels and Lubricants

Fuels and lubricants in motor bus operations will be the subject of discussion at a national forum being arranged by the Bus Division of the American Transit Association in Detroit February 17 and 18. Gasoline will be considered during the February 17 sessions from the viewpoint of the operator, the manufacturer, and the refiner. On February 18, crankcase lubricants will be the subject of discussion, also from the viewpoint of the operator, the manufacturer and the refiner.

The meetings will be at the Book-Cadillac Hotel, Detroit.

New Foreign Standards Received by ASA Library

The Library of the American Standards Association has recently received the following standards from foreign standardizing bodies. They may be borrowed by members of the American Standards Association. When ordering copies the number of the standard as well as its title should be referred to.

Australia

Carbon Steel Angles, Tees, and Other Rolled Sections for Boilers and Unfired Pressure Vessels and Their Appurtenances (B14-1940)

Interior Oil Varnish, Exterior Oil Varnish, and Flatting or Rubbing Oil Varnish (K14 to 16-1940)

Green Oxide of Chromium, Lead Chrome Greens, and Reduced Lead Chrome (Brunswick) Greens for Paints K71 to 73-1940)

Standard Grading Rules for Milled Flooring (03-1940)

Standard Grading Rules for Milled Lining (04-1940)

Standard Grading Rules for Milled Weatherboards (05-1940)

Emergency Standards for Aircraft Material

Phosphor Bronze Castings for Bearings, including Solid and Cored Sticks (E D701-1940) (2B8)

Aluminum Bronze Die Castings (E D702-1940) (DTD174)

Brass Bars Suitable to be Brazed or Silver Soldered E D703-1940) (3B11)

Aluminum-Nickel-Iron Bronze Bars, Forgings, and Stampings (E D704-1940) (DTD164)

Aluminum-Nickel-Iron Bronze Bars, Stampings, and Forgings (E D705-1940) (DTD197)

Chromium Bronze Bars, Extruded Sections and Tubes, suitable for Engine Valve Guides, etc. (E D706-1940) (DTD354)

Seamless Copper Tubes, for Oil, Petrol, Gas Starters, and General Purposes (E D707-1940) (5T7)

Brass Tubes for Honeycomb Type Radiators for Aircraft Purposes (E D708-1940) (4T47)

High Pressure Seamless Copper Tubes (E D709-1940) (2T51)

Aluminum-Nickel-Silicon Brass Tubes—Low Pressure E D710-1940) (DTD253A)

Hard Drawn Phosphor Bronze Bars and Tubes, suitable for Bushes, etc.—Bars not exceeding 2½ inches diameter (E D711-1940) (DTD265A)

Aluminum-Nickel-Silicon Brass Tubes, medium pressure (E D712-1940) (DTD323)

Canada

Procedure for Fire Tests on Building Construction and Materials (A54-1940)

Denmark

Pipes and Flanges—Round Threaded Flanges with Boss C 1 and C 2, Tn 2, 5-6, Dn 10-300 (580) Tn 10-16, Dn 10-300 (581) Oval Threaded Flanges with Boss C 1a, Tn 2, 5-16, Dn 10-100 (583) Round Threaded Flanges with Boss C 2, Tn 25, Dn 10-300 (585) Tn 40, Dn 10-300 (586) Tn 64, Dn 10-300 (587) Tn 100, Dn 10-250 (588) Round, Rolled-on-Flanges with Boss F, Tn 2, 5-6, Dn 10-300 (590) Tn 10, Dn 10-300 (591) Tn 16, Dn 10-300 (592) Tn 25, Dn 10-250 (593) Grooves in Rolled-on Flanges with Boss F, Construction-Sheet (599)

Pipes and Flanges—Round, Electric Welded Flanges G, Tn 2, 5-6, Dn 10-200 (600, Sheet 1) Tn 2, 5-6, Dn 225-1000 (600, Sheet 2) Tn 10, Dn 10-600 (601) Tn 16, Dn 10-400 (602) Round, Riveted-on Flanges H 1a, One-row-Riveted, Tn 2, 5, Dn 300-2000 (610) Tn 6, Dn 300-2000 (611)

Pipes and Flanges—Round, Welded-on Flanges J 1, Fusion-Welded Tn 2, 5, Dn 10-300 (620, Sheet 1) Tn 2, 5-Dn 325-2000 (620, Sheet 2) Tn 6, Dn 10-300 (621, Sheet 1) Tn 6, Dn 325-2000 (621), Sheet 2) Tn 10, Dn 10-300 (622, Sheet 1) Tn 10, Dn 325-2000 (622, Sheet 2) Tn 16, Dn 10-300 (623, Sheet 1) Tn 16, Dn 325-2000 (623, Sheet 2) Tn 25, Dn 10-200 (624, Sheet 1) Tn 25, Dn 225-1000 (624, Sheet 2) Tn 40, Dn 10-550 (625) Tn 64, Dn 10-400 (626) Tn 100, Dn 10-350 (627)

Pipes and Flanges—Round, Welded-on Flanges J 1, Fusion-Welded, Special Flanges for Hydraulics, Tn 16, Dn 650-1600 (629, Sheet 1) Tn 25-64, Dn 175-1000 629, Sheet 2)

Germany

Basic Standards (DIN Taschenbuch 1, Auflage 9, September 1940)

NOTE: This is available for use only at the office of the American Standards Association, and not for loan from the ASA office. The ASA will, however, be glad to transmit orders for the standard to the national standardizing body of Germany, but there may be delay in delivery because of delay in the mails.

Great Britain

Vitamins A and D in Oil for Animal Feeding Purposes (909-1940)

Controlled Cod Liver Oil Mixture for Animal Feeding Purposes (910-1940)

Naval Brass Die Castings (920-1940)

Rubber Mats for Electrical Purposes (921-1940)

Domestic Electrical Refrigerators (922-1940)

Impulse-Voltage Testing (923-1940)

Rubber Hose with Woven Fabric Reinforcement—Air, Low and High Pressure Water, Chemical and Brewers' Hose (924-1940)

The above standards are published in the language of the country from which they were received. In the list of Australian emergency standards for aircraft material, the second symbol number given is the British Standards Institution symbol for that standard. The British Standard was endorsed by the Standards Association of Australia without amendment and given an SAA symbol number.

Food Chains Show New Trend To A-B-C Grade Labels

Stores will use grade and information labels recommended by National Consumer - Retailer Council

A-B-C grade labeling has become active headline news during the past two months, after some 20 years of heated pro-and-con discussions. Several of the largest food chains in the country have announced plans to use grade labels on canned goods; and the A&P chain, already known for its labels, has adopted a more extended program. Furthermore, seven canning companies have made arrangements with the Agricultural Marketing Service for continuous inspection to check up on grades during the canning process.

This recent activity is attributed in part to the fact that, through the efforts of the National Consumer-Retailer Council, consumers and retailers have been able to meet together during the past two years to discuss their mutual selling and buying problems.

Association Recommends Labeling

As a result of these discussions, the National Association of Food Chains has recommended to its member stores that they adopt the grade labeling program outlined by the NCRC. Grand Union, Kroger, D. Pender, The Big Store Markets, and Rogers chains, members of the Association, have all announced that they are putting the program into effect for Grade A and B products. In addition, the A&P chain, which has been using grade labels for some time on its private-brand canned goods, has announced that it will use the NCRC-recommended type of label for the three—A, B, and C—grades.

The NCRC type of label, which is to be used by all of these chain stores, must give on the front panel all information required by the Federal Food, Drug, and Cosmetic Act and the grade of the product in terms of A, B, or C as defined by the United States Agricultural Marketing Service. The back panel must carry some interpretation of grade differences (such as a grade scoring table and comparable facts with regard to permitted defects); size or number of pieces designated in standard terms, or both; amount, in cups; and density of syrup.

The labels will also carry the statement: "This is the type of label suggested by the National Consumer-Retailer Council, Inc." Authorization to use this statement is granted by the Council under a standard licensing agreement set up by the Council and entered into with each distributor or manufacturer wishing to use the statement.

This agreement provides, among other things, that labels shall be resubmitted each year for reexamination by the Council; that the wording of the label shall not be changed after Council approval has been granted unless further written approval is obtained; that the company must have products tested by a qualified expert in accordance with methods acceptable to the Council before approval is granted; that the Council may request from time to time that additional samples be tested; and that the Council's approval shall not be used as an endorsement of any of the company's products. The Council also reserves the right to withdraw its approval upon failure of the company to abide by this agreement.

The Council requires that the label be used only for products which meet the requirements of standards and grades developed by the Agricultural Marketing Service. In addition, the Council approval is given to labels for canned products only if the distributor or canner makes the product available in at least two grades.

Grade Labels Are Yardsticks

"The reason for this decision is obvious," the Council explains. "Grade designations are in effect only yardsticks by which the consumer can measure the value to her of a given product. If a canned product is available only in Grade A, for example, the grade designation has comparatively little value as a device to measure quality differences. Furthermore, consumer organizations, in their long-continued efforts to achieve grade labeling, have repeatedly emphasized that they are not interested only in top quality products. All grades of canned foods are wholesome and nutritious and consumers wish to be free to select the grade best fitted to their purses and needs."

To date labels have been approved by the Council for the following canned fruits: apple-

sauce, apricots, fruits for salad, grapefruit juice, grapefruit sections, peaches, pears, red raspberries, red sour cherries, Royal Anne cherries. They have been approved for the following vegetables: asparagus, baked beans, beets, carrots, corn, green beans, lima beans, peas, pumpkin, sauerkraut, squash, succotash, tomatoes, tomato juice, and wax beans.

Not all the distributors who are using NCRC labels are packing all of these products under the Council label, and not all of these commodities are available in all three grades, the Council announces. Each product, however, is to be labeled in at least two grades.

On the other phase of the labeling problem, inspection of the product for grade labeling can either be done by the canners themselves according to government standards, or it can be done under the continuous inspection service of the Agricultural Marketing Service. When labeled under the AMS inspection service, the labels may appear as "U. S. Grade A," instead of simply "Grade A." Seven packers are now grading their products under this Government inspection plan: Bercut-Richards Company, Sacramento; California Conserving Company, San Francisco; N. Schuckl & Company, San Francisco; U. S. Products Company, San Jose, Calif.; Cherry Growers Packing Company, Traverse City, Michigan; Curtice Brothers Company, Rochester, N. Y.; and Florida Fruit Canners, Inc., Frostproof, Fla.

Business Week, December 28, sees a special significance in this recent grading and labeling activity:

"With large food distributors expressing a growing interest in certified grade labels on fruits and vegetables, major canners now recognize that a showdown is fast approaching on the question of grading under constant government inspection," it declares.

"The question has broad significance for all business, and what the canners decide—whether to adopt grade labeling generally, and if so, whether to do it under government supervision—will vitally affect the direction of the consumer movement. Number one demand of organized

Here the Grand Union Company uses the type labels recommended by the National Consumer-Retailer Council for Grade A and Grade B lima beans.

consumer groups is for product standards, and A-B-C grades on canned goods have come to symbolize the fight for standards of all kinds. . . .

"For the great bulk of non-participating canners, the government inspection plan is a taboo subject. Big canners who figure that grade labels are of less value to buyers than advertised labels are for the most part strongly opposed to the experiment, but refuse to take a public stand which might be construed as contrary to consumer interests. On the other hand, firms favoring the plan are loathe to let the fact be known until they can get in operation.

"The recent decision of some large wholesalers and food chains to try grade labeling—though not with continuous government inspection—has brought the canners' dilemma into the open. . . .

"Canning company officials claim that it has been the middleman who dictated to them what they should put on the label for the consumer. Now that there is a reaction expressed through consumer organizations, California canners aren't reluctant to give full information on labels but don't like the idea of having the policy forced on them by outside pressure. Soon after the experiment started in California last summer some industry spokesmen were saying privately that if 25 per cent of the canners subscribed to the government service the others would be obliged to fall in line. Today they have cut down that percentage. Many believe the issue has already been forced."

Surveys to Check on Consumer Desires

To check on what the consumer actually does want to find on labels, three different surveys are to be carried out. One of these is being supervised by Miss Alice L. Edwards, former secretary of the American Home Economics Association and member of the ASA Standards Council. This survey, under the auspices of the Agricultural Marketing Service, will have the cooperation of home economics departments of universities. Consumers in stores which carry canned goods with the U. S. grade legends will be questioned. A survey of this type already has been started at Macy's in New York City.

Women's Groups and Canners Association Study Labeling

Another study is being made by the consumer organizations under the direction of the National Consumer-Retailer Council. These organizations—the American Home Economics Association, the American Association of University Women, and the General Federation of Women's Clubs—are to carry out, through their local units, a study to try to determine whether the NCRC-recommended labels on canned goods enable customers to buy more intelligently, give them more protection in buying, and are preferred by them.

The third survey will be conducted by the National Canners Association, which appropriated $40,000, at its annual convention last month, to be used as follows, according to an announcement in *Business Week*, January 25:

"1. An objective survey will be conducted to determine just what the consumer would like to have, and canners are confident that the findings will point a preference for a clear statement about contents rather than just a lettered designation.

"2. The NCA laboratories will continue their experimental program designed to develop 'objective' tests for the determination of individual qualities and of standard terminology for their descriptions—'tiny, very small, small, and medium,' for example.

"3. The NCA will seek to 'sell' its descriptive labeling program to canners in all parts of the country by having representatives explain the meaning and operation of the program and by showing canners how to revise their labels to provide descriptive information."

ASA Standards Activities

Approved Standards Available Since Publication of Our January Issue

Steel Butt-Welding Fittings American Standard B16.9-1940 40¢

Standards Approved Since Publication of Our January Issue

Soldered-Joint Fittings American Standard A40.3-1941

Wrench-Head Bolts and Nuts and Wrench Openings (Revision of B18.2-1933) American Standard B18.2-1941

Methods of Testing and Tolerances for Tubular Sleeving and Braids American Standard L13-1941 25¢

35 mm Sound Film: Emulsion and Sound Record Position in Camera-Negative American Standard Z22.2-1941

35 mm Sound Film: Emulsion and Sound Record Positions in Projector—Positive. For Direct Front Projection American Standard Z22.3-1941

35 mm Film: Projection Reels American Standard Z22.4-1941

16 mm Silent Film: Cutting and Perforating Negative and Positive Raw Stock American Standard Z22.5-1941

16 mm Film: Projector Sprockets American Standard Z22.6-1941

16 mm Silent Film: Camera Aperture American Standard Z22.7-1941

16 mm Silent Film: Projector Aperture American Standard Z22.8-1941

16 mm Silent Film: Emulsion Position in Camera—Negative American Standard Z22.9-1941

16 mm Silent Film: Emulsion Position in Projector—Positive For Direct Front Projection American Standard Z22.10-1941

16 mm Film: Projection Reels American Standard Z22.11-1941

16 mm Sound Film: Cutting and Perforating Negative and Positive Raw Stock American Standard Z22.12-1941

16 mm Sound Film: Camera Aperture American Standard Z22.13-1941

16 mm Sound Film: Projector Aperture American Standard Z22.14-1941

16 mm Sound Film: Emulsion and Sound Record Positions in Camera—Negative American Standard Z22.15-1941

16 mm Sound Film: Emulsion and Sound Record Positions in Projector—Positive American Standard Z22.16-1941

8 mm Film: Cutting and Perforating Negative and Positive Raw Stock American Standard Z22.17-1941

8 mm Film: 8 Tooth Projector Sprockets American Standard Z22.18-1941

8 mm Silent Film: Camera Aperture American Standard Z22.19-1941

8 mm Silent Film: Projector Aperture American Standard Z22.20-1941

8 mm Silent Film: Emulsion Position in Camera—Negative American Standard Z22.21-1941

8 mm Silent Film: Emulsion Position in Projector—Positive For Direct Front Projection American Standard Z22.22-1941

8 mm Silent Film: Projection Reels American Standard Z22.23-1941.

16 mm Silent Film: Film Splices—Negative and Positive Am Rec Practice Z22.24-1941

16 mm Sound Film: Film Splices—Negative and Positive Am Rec Practice Z22.25-1941

Sensitometry Am Rec Practice Z22.26-1941

Photographic Density Am Rec Practice Z22.27-1941

Projection Rooms Am Rec Practice Z22.28-1941

Projection Screens Am Rec Practice Z22.29-1941

Nomenclature Am Rec Practice Z22.30-1941

Safety Film Am Rec Practice Z22.31-1941

Fader Setting Instructions Am Rec Practice Z22.32-1941

Nomenclature for Filters Am Rec Practice Z22.33-1941

Accident Prevention Signs American Standard Z35.1-1941

Allowable Concentrations of Carbon Monoxide American Standard Z37.1-1941

Allowable Concentrations of Hydrogen Sulphide American Standard Z37.2-1941

Allowable Concentrations of Carbon Disulphide American Standard Z37.3-1941

Allowable Concentrations of Benzene American Standard Z37.4-1941

Standards Now Being Considered by Standards Council for ASA Approval

Manhole Frames and Covers for Subsurface Structures A35.1

Keyways for Holes in Gears B6.4

Cast-Iron Pipe Flanges and Flanged Fittings, Class 250 (Revision of B16b-1928)

125 and 250 lb Cast-Iron Screwed Fittings (Revision of Am Tentative Standard B16d-1927)

Safety Rules for the Installation and Maintenance of Electrical Supply Stations, Part I of the National Electrical Safety Code C2, Part I

Installation and Maintenance of Electric Utilization Equipment, Part 3 of the National Electrical Safety Code C2, Part 3

Electric Fences, Part 6 of the National Electrical Safety Code C2, Part 6

Protection of Structures Containing Inflammable Liquids and Gases—Part 3 of Code for Protection Against Lightning (From status as American Tentative Standard to American Standard) C5, Part 3

A-C Power Circuit Breakers C37.4

Methods for Determining the Rms Value of a Sinusoidal Current Wave and a Normal Frequency Recovery Voltage C37.5

Schedule of Preferred Circuit-Breaker Ratings C37.6

Operating Duty for Standard and Reclosing Service C37.7

Rated Control Voltages C37.8

Test Code for Oil Circuit Breakers C37.9

Commercial Standards for Sun Glass Lenses (CS 78-39; CS 79-39)

Hard-Drawn Copper Wire H4.2

Medium Hard-Drawn Copper Wire H4.3

Standardization of Sizes of Children's Garments and Patterns L11

Fastness Tests for Dyed or Printed Cotton L14

Proposed American Recommended Practice for the Use of Explosives in Anthracite Mines M27

Northern White Cedar Poles 05b1

Western Red Cedar Poles 05c1

Chestnut Poles 05d1

Southern Pine Poles 05e1

Lodgepole Pine Poles 05f1

Douglas Fir Poles 05g1

(The above six standards in the Wood Pole group are under consideration as American Standards from status of American Tentative Standard)

Safety Code for Grandstands Z20

70 mm Perforated (and Unperforated) Film for Other Than Motion Picture Purposes (Cutting and Perforating Standard) Z38.1.3

Valid Certification Z34

New Project Authorized

Safety Code for Dry Cleaning Operations Z42

New Projects Being Considered

Domestic Electric Flat Irons

Attachment Plugs and Receptacles